ANNALS

of the

Association of American Geographers

Volume XXXIV DECEMBER, 1944 No. 4

Training for Geographic Research

A Symposium

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Just as World War I left its imprint upon the trend of geographic activity in the United States,[2] so World War II has stimulated increased interest in the science of geography both among professional men and laymen. Shortly after the present conflict began, the Association joined with Section E of the American Association for the Advancement of Science (December, 1940, Philadelphia) in the presentation of papers pertaining to "The Geography of National Defense." The purpose of this meeting was to give emphasis to the contribution which the science of geography could make to the conduct of war and to subsequent reconstruction.

Although it is doubtful whether the papers exerted a direct influence upon the widespread employment of geographers by various government services, the fact remains that every geographer who could be enticed from his peacetime activities has been enlisted in some phase of the prosecution of the war. The duties performed by these persons involve not only the application of geographic data to the conduct of the war but considerable research to produce the data. Among those employed is an unusual number of young men and women whose training in geography has been recent and whose experiences in consequence have been somewhat limited.

[1] The symposium here presented is introduced by Professor Van Cleef, to whom the task of its organization was entrusted and who was to have led the session of the Association meeting for which the papers were prepared.

[2] War, Peace and Geography—An Editorial Foreword, *Annals of the Association of American Geographers,* 1941, Vol. XXXI, No. 2, pp. 77–82.

As the termination of the European phase of the war seemed not far distant, President Whittlesey and Secretary Brown decided that a symposium treating with the training for research, of aspiring geographers would be appropriate for one of the sessions of the 1944 meeting of the Association. The meeting was postponed in response to the suggestion of the Office of Defense Transportation in the interest of curtailing railroad travel. However, the editor of the *Annals* has made it possible to preserve the papers constituting the symposium by granting space in this issue.

The theme "Training for Geographic Research" seems fitting at this particular time because the hiatus in peace-time research may be viewed in a sense as marking the end of an era in the growth of the geographic realm. Furthermore, the probability of post-war changes in educational programs as well as in the social, economic and political activities of man make it desirable for geographers to give renewed consideration to the type of training which might yield the best results in the immediate future.

Obviously in the time allotted the field of geography in its entirety could not be discussed. A selection of certain phases had to be made. The choice was based upon the probable relative importance of each aspect to the continued growth of the science. The selection of "military geography" as one division for consideration was predicated upon the observation already indicated, namely, the current employment of unprecedented numbers of geographers by the military services of the national government. In consequence, the attention of professional geographers has been focussed upon military geography as never before, and these same persons have been looking forward to the further development of this field. Physical, economic and political geography have been reasonably well developed, but the training of neophyte geographers for research in each of these fields undoubtedly can be greatly improved or at least will require revision in the light of a turbulent world which we believe will again return to some semblance of stability but not in the same pattern as of pre-war days.

Columbus, Ohio
September, 1944

Physical Geography in the Training of the Geographer

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GENERAL STATEMENT

In a discussion of the rôle of physical geography in the training of the geographer, it is first necessary to be sure that the statement is understood. What geographer do we discuss? Obviously we might consider the ideal geographer who, perfectly trained by the combined efforts of the best in this generation, will go boldly, unhesitatingly forward to solve the problems that will arise in the next generation. Or we would perhaps be wiser to consider the superior young man who, enthused by the modern type of geography, will by diligence and good sense qualify himself for one of the major posts in geography. His interests like those of the present leaders will lie in the relation of man to his environment. He will be a "systematic" or "regional" geographer or a combination of the two as are most of the present leaders.

We must now consider what is included in physical geography. Obviously all the factors of environment except those induced by the presence of animal and plant life are "physical." As, however, life has been present on the earth since far back in the Pre-Cambrian or for a period of more than a thousand million years, the influence of plants and animals on the "physical" processes current during earth history cannot be wholly disregarded. In fact the biologic influence cannot be successfully differentiated except by arbitrary assumptions in analysis. By custom and historical precedent our existing divisions of physical geography include many processes in part biologic in character. The distinctions between zoogeography and plant geography on the one hand and physical geography are arbitrary. The distinction is similar in all respects to that between physical geography and "human" geography. Yet these categories, difficult as they may be to defend in theory, have their advantages in practice. In the discussion of educational problems such distinctions have their greatest usefulness. The "wholeness" of knowledge and the "oneness" of geography impress themselves on the mature. To the beginner and the immature the categories of knowledge are a necessary scaffolding for the building which is eventually to contain his realization of geography as a single entity.

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PHYSICAL GEOGRAPHY, THE FOUNDATION OF GEOGRAPHY

If one wishes to inspire interest and enthusiasm, geography should be treated as a whole. Thus James' well-known textbook is one continuous account of man's relation to environment. This imaginative and well-written book is a thrilling experience for the mature scholar. On the other hand the student may already have or may be assumed to have interest and enthusiasm. On this assumption the old-fashioned textbook in physical geography is logically arranged. It begins with an account of the earth in space and in the planetary system. It describes the continents and oceans. Thus it gives an account of the fundamental rhythms of day and night, of summer and winter, of the tides, etc. It treats of the history of the earth and particularly of the forms of the land. It considers the movements of the air and the origin of weather. The summation of experience with weather we call climate, and to the nuances of climate the whole plant and animal world is adjusted. Thus climatology ranks high in such a physical geography and from its study stem subdivisions of the other categories. Soils, land forms, plant and animal geography have their climatic subdivisions and trends.

The "human geographer must have a firm grasp of the subjects generally considered as "physical geography."

METHODOLOGY

If we consider the working techniques necessary to research in geography, many of them pertain to or are simplifications of methods used by those who are considered "physical geographers." Thus surveying and all the field methods of geography have been developed largely by topographers and geologists or are adaptations of their techniques. The geographer must understand not only the general methods of map-making or cartography, but much of the detail so that he may understand the limitations of method and the degree of precision attained. He must also adjust his own methods so that his precision is in accord with the character and value of the data that he gathers and the base map which he may use. Elementary courses in surveying or specialized training in field methods, involving survey methods, are obviously requisite.

The representation of data on maps is the heart of the geographic method in all fields. Cartography in its broader aspects and definite training in map drafting are requirements for a career in geography. How much time the student should spend in course work on such subjects depends in part on the student. His aptitude for geography implies that he has a visual sense, and that he conceives in pictures and diagrams. Thus he may dispense with much of the formal training necessary for a cartographer. He cannot, however, shirk this field of training as being mere "drafting" and below

his professional dignity. Even if a young geographer is assured that he will always have funds to hire a draftsman, which few are, he cannot supervise and direct the work of such a draftsman without an intimate first-hand knowledge of the art.

A casual inspection of geographic publications of the past 10 years indicates that many geographers are assuming some such contemptuous attitude. Their published maps are carelessly drawn, on inappropriate scales, and lack emphasis. Obviously they ignore the long-continued efforts of the *Geographical Review* to maintain standards of cartographic representation. They ignore the example set by many leading geographers. They forget that the prime obligation of a geographer is to produce a good map. Time, thought, and money are never wasted on the production of a map which shows clearly the relation of one thing to another on the earth's surface.

The use of maps as vehicles of propaganda has been advocated recently by the "geopolitical" pseudo-geographers of Germany. Obviously they are unfamiliar with the efforts of the American advertiser. The brochures of our chambers of commerce, the familiar railroad time-tables, the advertising pages of our magazines all contain maps used as propaganda. Distortions, overemphasis, violent contrasts in shade and color and other devices are the common aids to creating the mental effect intended. Our youthful geographer might well study these skillful artifices of the advertiser. No one would advocate that the young geographer should indulge in the cartographic extravaganzas of the advertiser. He might, however, learn simplification and emphasis, qualities that would vastly improve our current geographic literature.

The general standards of cartography and of the great map series are maintained at a high level by the great governmental survey organizations. It is, however, the duty of the geographic profession and particularly the "human" geographer to maintain equally high standards in the representation of man's activities and works in relation to his environment.

WHAT ARE THE IMPORTANT DISCIPLINES IN PHYSICAL GEOGRAPHY?

If we assume, as seems to be true, that the continents have been changed but little in shape and topography during man's existence, obviously the most important geographic factor in his distribution is climate. All the great "ecumenes" of today lie in areas of "favorable" climate. Obviously climatology is the *sine qua non* of the "human" geographer. He should be trained by specialists in the field and seek not only a broad acquaintance with the facts but a sound knowledge of meteorological theory. Our present climatology is empiric. It is an encyclopedic compendium of known climatic facts. Some day in the future we may hope that a rational climatology will

be perfected. It will be based on the new air-mass meteorology and those who have neglected meteorology will find themslves woefully out of step.

Soils are the result of the weathering process operating through time and thus are related to the distribution of rock and to climate. This big and important field is also related to geomorphology or the science of land-forms. Land forms are the result of geologic process, either erosional or depositional, operating through time under the influence of climate. Both soils and land forms are also influenced in their character by the vegetative cover. Thus if one wishes he might consider that plant geography, soils and geomorphology are subdivisions of one subject—the study of the land surface on which man lives. Unfortunately it is impossible to find a man sufficiently learned to teach all of these subjects as a single whole. Furthermore, the data and the several analyses are so voluminous as to require several years' courses. The aspiring geographer must master them and make his own integration by which they become the tools, the working methods, the grand congery of facts on which he interprets the life of man.

The world of water is separate from the land world. Oceanography and hydrology (potomology, limnology, glaciology and ground water) are separate disciplines, each with its advocates and experts. To each of these subjects the geographer must give time and thought. Large parts of these subjects are given elementary treatment in geomorphology but separate and special effort in these fields is necessary for the human geographer. One of the vital and pregnant ideas in geography is that the contact zone of land and water is the *locus* of the most intense and diversified human activity.

PRACTICAL MEASURES

To determine the extent of training in each of the separate fields of physical geography necessary for the "human" geographer is the problem of the graduate schools. Should training lie largely in successive courses in "human" geography, in each of which examples of man's relation to his environment is set forth? Or should the main emphasis be placed on the two great elements of the problem (1) the environment (physical geography) and (2) human organization (material civilization, history and sociology)?

Obviously each graduate school will answer this question in its own way. Differences of viewpoint, personnel and academic tradition will play their parts. As to physical geography, one may be sure that the best teaching will be done by specialists. Only those devoted to the many branches of this complex subject can give substance to theory, attractiveness to fact. Those parts of physical geography which are methods cannot be neglected. So far as the great bodies of principle are concerned, it is hardly to be expected

that every student must be equally accomplished in all phases of physical geography. Tastes, background, and opportunity differ. Furthermore, a measure of diversity in training leads to differentiation of interest and viewpoint. Just as differences of opinion make horse races, so equally they will stimulate thought and effort in so complex and intricate a subject as geography.

THE "PHYSICAL GEOGRAPHER"

Perhaps unfortunately science has developed in such a way that physical geography as a separate discipline has largely disappeared. It has fallen into the hands of specialists in the narrow divisions of the subject. Each of these divisions is a separate field of study bound to the others by the tenuous thread of a geographic background. One can claim a unity for all the "earth sciences" because they deal with the problems of the earth, but in the ultimate all knowledge being acquired on earth by man, even that astral science, astronomy, is earth-bound and in part anthropocentric. With Sten de Geer one can argue that geography is a universal science like mathematics. It deals with distribution whereas mathematics deals with numbers. From this viewpoint geographic analysis may be applied to any body of fact or principle. Such a description of geography is not quite correct in fact, as mathematics deals with space as well as numbers, and geography considers the quantities distributed as well as the fact that distribution exists.

Yet it is true that many subdivisions of science have a distributional and, therefore, geographic aspect. Climatology is not just the compiled mass of accumulated data on meteorology. It is a geographic science in that meteorological phenomena have a distribution and a relation of other phenomena to the distribution. Meteorology, however, is a branch of applied physics pursued for its own sake and for economic benefits to agriculture, engineering and aviation. The distribution of the accumulated data and their analysis is a statistical study. It is most valuable and penetrating when the analyst is a soundly trained meteorologist. Thus one must insist that the climatologist should be trained in physics and mathematics. His training in geography is part of the necessary consideration of the economic bearing of his work. He is forced to consider the relation of other features of the earth or its inhabitants to areas characterized by given climates.

A similar analysis can be made of geomorphology. As Campbell and Douglas Johnson pointed out at length in presidential addresses before this society, the methods of study are essentially geologic. Davis always insisted that the objective is geographic, i.e., the clear, explanatory description of land forms. His geologic colleagues, however, regarded his numerous assertions or manifestos on geography as a mere personal idiosyncrasy. To them analysis of the origin of land forms is merely one of many geologic

methods for inquiring into the history of the earth. However useful geomorphography may be to geography, geomorphogeny is the prime and necessary first objective. So far as the training of future geomorphologists is concerned, this conclusion must be accepted. The geomorphologist to succeed must be a thoroughly trained, all-round geologist. He should also be conversant with climatology, plant geography, soil science and hydrology. These fields are intimately related to the dynamic processes that produce land forms. He cannot ignore the results of modern studies and advances of these active sciences. Thus the well-trained geomorphologist is likely to have a broader knowledge of physical geography than others. He is likely to be in the future one of the few qualified successors of the old-fashioned natural historian. The interrelationships of his work with "human" geography will be close, and he should work with full knowledge and understanding of the use to which his product may be put. Cooperation with the "human" geographer depends, however, in part on the attitude of each and can be much facilitated by mutual respect.

Soil science is a rapidly developing subject. Largely inspired by the economics of agriculture, emphasis has, heretofore, been largely on the biochemical and bio-physical characteristics of the soil. From the standpoint of origin, however, soils are weathering products. They arise from the intimate interaction of climatically determined bio-geologic processes on geologic materials. The close relation between climate, vegetation and soil, first set forth by Hilgard and reemphasized by the Russian school, has broadened the philosophic base on which soil study rests. We may, therefore, expect that in the future training of soil scientists, climatology, geomorphology and plant geography will play a greater rôle than heretofore. The recognition that many soils are polygenetic and are the product, not of one continuous soil-making process, but of two or more processes, the results of which are superimposed, is of very great importance. To the extent that this possibility is recognized, soil science becomes paleopedology. Paleopedology is obviously a geologic science and there is a complete merger with geomorphology.

Plant geography has for its specific objective the origin of species and genera by an analysis of distribution. Like geomorphology, this biologic objective, pursued largely by botanists for botanical motives yields large bodies of data useful to the geographer. The plant geographers have been divided into schools pursuing more or less separate paths in floristics, plant ecology and phytogeography. These differences seem to be on the wane. Heretofore, each plant geographer has begun as a botanist and has been largely self-taught in cartography, climatology, paleobotany, and geomorphology. Obviously plant geographers should be more broadly trained. The present forward movement, so evident in the work of Raup and Cain,

should lead to a more complete training of plant geographers in geographic methods and geologic principle. Advantages will accrue not only to plant geography, but also to geography in general. Our present background in plant geography rests on the broad mapping and generalizations of a past generation. We need the stimulus of new and more broadly based work in the many interrelationships of plant cover with climate, soils and geomorphic processes.

Hydrology has long been the field of the scholarly engineer. Data on flowing water is expensive to gather. Most of it has been accumulated by government agencies for economic reasons, and an adequate body of data is only now becoming available. The Geophysical Union provides a center to which have adhered many scientists from many types of organizations and of diverse interests. Studies of run-off, infiltration, floods, snow accumulation and dissipation, ground water inventory, etc., have begun to form a strong body of fact and of analysis. This material is of large importance. It provides a quantitative rational explanation for many phenomena of physical geography. There will be strong reactions in all the subdivisions of the subject. That hydrologists are primarily engineers is inevitable. Many are unaware of the geographic implications of their work. Others realize that with climatology there are strong interrelations, and many cooperative ventures have already arisen. New relations, however, await the geographer who learns to use this new source of data for broad generalizations.

CONCLUSION

Physical geography has a unity when viewed from the standpoint of the human geographer. From the standpoint of the "physical geographer," it is a group of special sciences, each pursued for its own end. Unity of these specialties lies in their common concern with the earth, with distribution and and with the relationship to man's activities. Overemphasis of this unity gains little. The student of "human" geography may recognize the unity, but he must acquire the principles, and certain skills, consciously and sometimes painfully from specialists. The students of the specialties may pursue their work with little contact with geography. We may be convinced that this is a loss to them, but we cannot force geography on them. Geography must gain adherents by the force and brilliance of its achievements. It must be interesting and worth while. As yet it makes converts in the specialties of physical geography mostly among mature men. To gain among the young, especially the students, requires devoted and inspired teaching by the already convinced specialists. It also requires that geography as a whole shall maintain a high standard of performance so as to deserve respect and inspire emulation.

Training for Research in Political Geography

JOHN K. WRIGHT*

Political geography is perhaps the most "human" phase of geography, since it deals so largely with the strengths, weaknesses, and ambitions of men. If political geography itself had reached a more mature stage of development, it would be easier to discuss the problem of training for research in it. As things stand, so much of the field is still virgin that the pioneers who venture into it will receive the better part of their training through actual cultivation of its soil. One might, of course, select a number of the most urgent political problems facing humanity today—collective security versus balance of power, or the future international position of China, or what not—and try to figure out how persons should be trained to investigate them from the geographical point of view, but any such selection could represent only a small fraction of the many types of problem with which political geography might potentially deal, and furthermore no two individuals would ever agree on what are the "most urgent problems." My approach will be more general.

Obviously those responsible for training others to undertake research in political geography should, first, have as clear a notion as possible of the various topics with which such research might deal in a useful manner, and then try to develop in their students the proficiencies needed for conducting such research. In this paper, accordingly, the potential scope of political geography and the question of training will be discussed separately.

THE SCOPE OF POLITICAL GEOGRAPHY

The diagram (Fig. 1) illustrates a conception of political geography. The two boxes at the upper corners of the triangle stand for any two or more political groups. The box at the lower corner stands for "the earth"—i.e., the earth's surface and associated terrestrial phenomena. The sloping lines represent relationships between "the earth" and political groups considered as separate units (such, for example, as the relationships disclosed by ordinary "political" maps showing states, provinces, and other governmental units, or maps of the distribution of coal, iron, or other natural

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resources in relation to such units). The two solid horizontal lines stand for "political contacts" between the groups, either of conflict or of co-operation. As distinguished from purely areal or spatial contacts, political contacts involve action, such as conducting election campaigns, waging wars, or concluding treaties. The heavy vertical line stands for the relationship of these contacts to the earth.

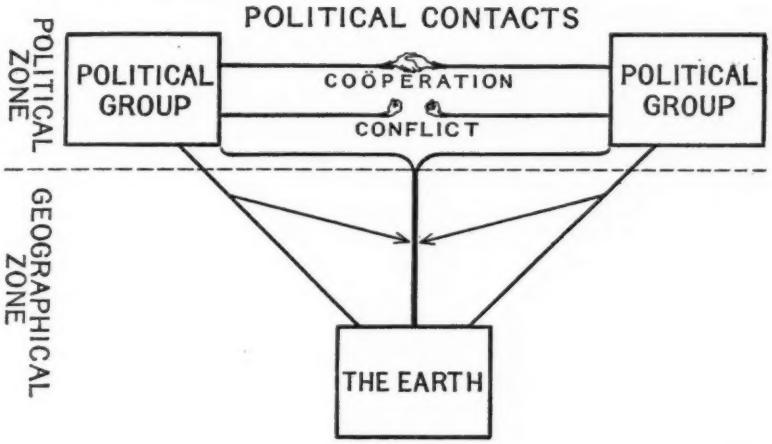

FIG. 1

For "political groups" we might substitute "any human groups" in the diagram. The triangle would then suggest a wider realm of study, of which political geography would be only a part (though perhaps the most important part): "the geography of active human contacts." This immense field would embrace the whole great triangle of Men, Other Men, and Earth—a triangle as old and fully as perplexing as the proverbial one that is commonly called "eternal."

However this may be, most geographers would doubtless agree that the heavy vertical line stands for the central core of political geography, and that, while studies of the facts represented by the sloping lines are essential, they are merely contributory to studies of the contacts between political groups as symbolized by this line. This central core, of course, has been and might be investigated in a great many different ways, ranging from the quest for principles or generalizations of worldwide application to the detailed factual examination of specific regional or even local contacts. The focus may be upon the contacts of the political groups within a particular area, such as a continent or a county, or on those of a particular political group, such as a nation. Geopolitics, I take it, is the geographical study

of the contacts of a specific political group, usually a nation, when such study is pursued for the purpose of promoting the interests of that group. Another approach is to concentrate on the analysis of a particular type or manifestation of political action (e.g., plebiscites, arbitration, war), or the relationship of political contacts to a particular aspect of the environment (e.g., the sea, as exemplified by Mahan; or mineral resources, etc.). The present global war has stimulated many studies of political contacts in terms of the purely geometrical relationships of position and direction on the earth's surface. (Such relationships are, of course, geographical as well as geometrical, but they fall far short of being the *only* geographical relationships, as some recent popular writers might lead one to think.) But, whatever may be the actual subject of his research, the political geographer must know his way about in two zones of knowledge.

The broken horizontal line in our diagram is the boundary between these zones—the "political" one above and the "geographical" one below. As this paper is addressed to professional geographers, it hardly seems necessary to discuss the geographical zone in any detail. This is familiar ground, and the reader's imagination may be counted upon to suggest the nature both of the pertinent terrestrial facts and of the various geographical techniques that might be used in correlating them with the political facts. In the upper zone, the "stamping ground" of politicians and political scientists, most geographers are less at home. The political geographer, however, might do well to conceive of the configuration of this political zone as systematically as he presumably conceives of the geographical zone, and, furthermore, his conception of it ought to be adapted to the purpose of correlating its features and processes with those of the geographical zone, a purpose that ordinarily differs considerably from that of the political scientist or politician.

In the following paragraphs I shall present a tentative classification of the main features of the political zone, followed by a few hints as to how the facts of the political zone might be studied geographically.

Nature of Political Groups

Any combination of people which *as a group* acts politically is a "political group." In this discussion "political action" will be regarded as action connected solely with political government, though it could, of course, be conceived as any action that savors of "politics" in the broadest sense of the term. Non-governmental politics of the kind that is known, for example, sometimes to rage in universities, is not normally considered a subject for research in political geography. Military action, however, is governmental political action carried to its furthest extreme, and hence military geography may properly be deemed a highly specialized branch of political geography.

For the purposes of political geography, useful criteria for the classification of political groups are those of *size, essential function,* and *relative power.*

Political groups form hierarchies of lesser within larger groups. They vary enormously in *size*—e.g., from factions within villages to the whole populations of huge coalitions of nations.

In terms of *essential function* they fall into two main categories: 1) primary or territorial groups, and 2) secondary groups. In the hierarchies of primary groups the most important units are nations. Other primary groups comprise the entire populations of such combinations or subdivisions of national states as alliances and coalitions, empires, provinces, colonies, municipalities, wards, precincts, etc., and for convenience these entities themselves will sometimes be referred to as political groups (e.g., "province" instead of "provincial group"). The political action of primary groups consists in maintaining, in submitting to, and sometimes in rebelling against the governments in authority over them.

The secondary groups comprise parts only of the whole populations of primary groups. They also form hierarchies, but these are not organized along such definite and clean-cut lines as those of the primary groups. Functionally, the most important secondary groups are political parties; other groups consist of factions within parties, "pressure groups," lobbies, etc., and sometimes even of unorganized mobs. The political action of the secondary groups consists in efforts to gain influence or control over, or to resist control by, the governments of the primary groups. Most secondary groups operate largely in the interests of various non-political groups—linguistic, religious, industrial, agricultural, commercial, and the like.

Political groups differ profoundly from one another in the *relative degree of political power* at their command. In this regard there are two modes of comparison. One is "horizontal"—that is, the relative power of coordinate groups is considered: nations in comparison with nations, provinces with provinces, or parties with parties. The other is "vertical," the power of lesser groups being compared with that of the larger groups of which they form component parts—municipalities with provinces, provinces with nations, factions with parties, parties with nations. In a loose federation of states, the political power of the smaller component groups is greater in relation to that of the whole federation than in a highly centralized state. In a totalitarian state a single secondary group, a political party, dominates the whole nation.

Political power is derived from the inherent energy of political groups and from the material means that they possess for giving effect to this energy. We shall come to the matter of means a little later. The inherent

energy of a group is largely a function of its cohesion. Cohesion may be achieved voluntarily by the component elements, as in a democracy, or else it may be enforced upon them by dominant elements, as in an autocracy. Frequently it is maintained by fear of aggression from without. Enforced cohesion brought about by repression or cohesion due to fear may at times give rise temporarily to mighty political power, as the recent examples of Germany and of the United Nations show. Such cohesion, however, may suddenly dissolve when the dominant elements lose their grip or the causes of fear are removed.

The Nature of the Political Action of Groups

Political groups are to political geography what landforms are to geomorphology. Geomorpholgy aims to describe, classify, and map the distribution of landforms and to explain the processes that create, mold, and destroy them. Political geography aims not only to describe, classify and map political groups, but to explain the processes that affect them in terms of the relationships of these processes to "the earth." Most of the processes with which geomorphology deals are due to forces that originate outside of the landforms themselves—in the atmosphere, the ocean, streams and lakes, and the depths of the earth. The forces and processes with which political geography is concerned, on the other hand, originate largely within political groups themselves, in an immense complex of human desires and needs.

In geomorphology it has long been an instructive practice to differentiate between the physical forces and processes that build up and those that wear down landforms—between constructive and destructive processes. This distinction can usually be made in a clean-cut manner. Weathering and erosion are clearly destructive; uplift and alluvial deposition are clearly constructive. Political processes also are both destructive and constructive, but here it is not so easy to make the distinction. Most of the political processes of which one usually thinks, are comparable to such geomorphic processes as stream action or wave action, which are constructive of certain landforms and destructive of others. It is, however, entirely feasible to make a precise distinction between two major categories of political process, a distinction based on the nature of political action itself rather than on its more debatable results. *This distinction is between processes of cooperation and those of conflict.* Indeed, political action that does not involve either cooperation or conflict is inconceivable. All political activities in which individuals or groups work together toward common purposes—the establishment and maintenance of governments, of law and order within nations, and of peace between them—are cooperative. All political activities in which individuals or groups work against each other are processes of

conflict. As long as peace prevails the processes of conflict are subordinated to and operate within a larger framework of cooperation. In war the reverse is true. Then the subordinate cooperative processes are often enormously intensified to subserve the dominant processes of conflict.

The distinction between cooperation and conflict is not wholly unconnected with that between constructive and destructive political processes. The specific processes which may be assigned to these categories are usually, like stream action, destructive in certain places and constructive in others. The cooperation of certain groups, while constructive in respect to those groups themselves, may be destructive of their enemies or rivals, and conflict, while destructive of the losing side, may be constructive from the winners' point of view. The terms "constructive" and "destructive" can also be used in a more absolute sense, with reference to human civilization as a whole. Only extreme militarists deny that the processes of human cooperation throughout the ages have been constructive and those of conflict destructive of the things and ideals that men cherish the most.

Indeed, the greater evils that afflict human beings today have sprung from political conflict, and one of the most urgent of the tasks that confront men of science today is to seek for a better understanding of the processes of conflict that produce these evils and of the cooperative processes that tend to counteract them. This is why there is value in the conception of political geography as concerned fundamentally with the nature of political cooperation and conflict and why researches in this field might well be consciously oriented to shed a maximum amount of direct light on these two modes of political action.

If this were a rounded treatise instead of a short paper, I should go on from here to discuss both modes. Some comments on the matter of conflict, however, will have to suffice. I trust that they may suggest to the reader comparable ideas regarding cooperation.

Political Conflict

There are many kinds of human conflict. My ideas or interests may be in conflict with yours without either of us doing anything about it. This is static conflict. If we argue or fight it is dynamic conflict. If our ideas and interests continue to conflict over a long period with occasional outbursts of argument or fighting, it is chronic static conflict punctuated by acute dynamic conflict. If we merely argue, it is non-physical, or verbal, conflict, but if we fight it is physical. When I make my ideas or my interests prevail over yours the conflict is resolved, but if neither prevails it is unresolved.

These distinctions apply to political as well as to personal conflict, and

political geography potentially embraces all types of political conflict. It may be concerned with the chronic, long-lasting, static conflict of ideas and interests between political groups or with specific instances of dynamic conflict. In either case it considers the causes and results of conflicts, the means employed in conducting them, and their manifestations at particular times and in particular areas.

Causes and Results

If all men were equally satisfied with their destiny and did not strive to get the better of one another, there would be no political conflict. Nature and human ambitions, however, have given certain groups advantages, which they seek to preserve and enlarge and which rival groups seek to overcome. These differential advantages are the root causes of political conflict. They show themselves in the possession of, or the control over, those things and conditions that contribute to the enjoyment of life and power—tangible things such as resources in materials and men, geometrical circumstances such as the occupation of advantageous positions on the earth's surface, and intangibles such as technological skill, political cohesion, energy, etc. The specific issues of conflict in its acute form are almost invariably connected in one way or another with these differential advantages, and the end results of conflict can invariably be summed up in terms of the change brought about in such relative advantages.

Means

The means of political conflict consist in the *measures* and the *instruments* used by political groups in applying force. The force itself may be either non-physical or physical. Non-physical—or we might call it "verbal" —force is applied in electioneering, in legislative debates, in diplomatic meetings, in legal arguments, through newspaper editorials, and in political propaganda. It is given effect through such *measures* as court injunctions and decisions, treaties, embargoes, economic sanctions, the enactment of laws, etc. It is force exerted in the first instance against the minds rather than directly upon the bodies or possessions of those toward whom it is directed. These minds may resist it; or they may yield to it either through fear of the consequences or because of inner conviction that to yield is reasonable or in the best interests of society. Physical force is resorted to only when verbal force does not suffice, or it is believed that it may not suffice, to accomplish the desired purposes.

The *instruments* of political conflict comprise the various human and material resources, institutions, and mechanisms that are either actually employed or could potentially be employed in the application of force of either

kind. Frequently verbal force is applied in the form of threats that the potential instruments of physical force will be used. The instruments do not consist of material things alone. They include intangibles, such as having a case that is, or can be made to appear, the more just. Possession or lack of the instruments of political conflict add to or diminish the differential advantages of political groups, and hence such instruments may constitute both the causes and the means of conflict.

In war a large fraction of the potential instruments of conflict are converted into immediate instruments—manpower into armies and navies, natural resources into guns and ships and planes, advantageous positions and boundaries into the direct utilization of the advantages associated with them; and a just or plausible case into active propaganda for that case.

Manifestations

Precisely how, where, and when does political conflict occur? One might regard it as occurring only at those points where the opposing forces collide. In the case of physical conflict these points and what happens at them can usually be definitely identified in place and time, in most instances on battlefields. In the case of nonphysical conflict the nature, time, and place of the actual collision of forces are not always so readily recognized. Where, when, and how does the collision occur that is resolved in a political election? It occurs in the minds of individuals scattered over large areas and it may last over many months or years. In a political conflict resolved by legal or diplomatic means the collision may occur in a conference hall or courtroom far from the areas where the issues of the conflict have arisen. Hence, except in so far as physical conflict is concerned, the actual place of collision may be of little significance in political geography, and the manifestations of conflict might better be regarded as occurring over the period of time during which the maneuvers and movements unfold that bring the issues to the point of collision and that follow immediately after. Obviously no sharp lines can be drawn between this period and the longer preceding and succeeding periods in which the factors of cause and effect alone might be considered as operative.

THE GEOGRAPHICAL STUDY OF POLITICAL GROUPS AND OF POLITICAL CONFLICT

What does the foregoing classification suggest with regard to geographical research? One way of considering this is to allow the imagination to roam over the various facts for which the classification provides a frame of reference—to roam in an exploring expedition into new possibilities of employing existing maps to illuminate these facts and of mapping some of those

facts for which no maps now exist. While research in geography is by no means a matter solely of making and interpreting maps, a good preliminary test of the potentialities of almost any set of facts as subjects of geographical investigation is whether or not they are capable of cartographic expression.

If maps of any one type could be said to occupy the same basic position in political geography as that of topographic maps in geomorphology, they would be maps disclosing the distribution of population in relation to political boundaries. Maps of this kind reveal the fundamental geographical anatomy of the primary political groups.

We have seen that political groups vary enormously in size. Any and all political groups are proper subjects of research in political geography. The fact that such research has for the most part been devoted to national groups as represented by sovereign states, is no reason why studies could not be profitably pursued with respect to very much smaller groups. Thus the "micro-political geography" of local or regional groups might well be developed along interesting and original lines. Especially worth while would seem to be studies in the micro-political geography of regions that are critical from either the national or international points of view (e.g., the "core areas" of Whittlesey or certain frontier areas). Such studies, although on the micro-scale in their immediate scope, bear upon what might be called "meso-" and "macro-political geography" by those who like such terms, the "meso-" type having to do with nationwide and the "macro-" type with international affairs.

Some political phenomena lend themselves much more readily to geographical analysis and interpretation than do others. This is because maps, statistics, and other information are already easily available regarding the geographical distribution of these facts. A good deal of this information has already been exploited in political-geographical studies. It consists in general of facts concerning the distribution of population in terms of primary political groups, and the distribution of certain nonpolitical groups—linguistic, religious, and occupational, for which census data are available—also of facts concerning material things (natural resources and manpower), and geometrical relationships (including political boundaries) which contribute to the differential advantages of nations and constitute instruments of conflict; and, finally, of facts concerning the manifestations of physical, particularly of military, conflict.

The more virgin parts of political geography are those concerning the more intangible facts and concepts. Take, for example, the "vertical" relationships of the power of primary groups. If satisfactory criteria could be established on which they could be based—and this might be possible—maps showing the degree of self-government enjoyed nominally and actually by primary groups of various ranks would be revealing indeed. Together with

the geographical study of secondary political groups, they would illumine the matter of political cohesion and help to establish the geographical lines of cleavage along which political groups tend to split apart. In this country historians rather than geographers have taken the lead in studying these lines of cleavage and in the geographical analysis of secondary groups—witness the work of Turner and others. A good many maps already exist relating to secondary groups (e.g., the distribution of votes in elections and upon Congressional measures). On the other hand, some of the most powerful nonpolitical groups, in whose behalf the secondary groups act or which seek to exert direct influence on governments and their policies, have largely escaped geographical study—for example, cartels, and other industrial groups, and also agricultural, commercial, and labor groups. The competitive nature of most of these organizations causes them to keep to themselves many of the data on which maps and other geographical studies could be based.

When we turn to political processes, we see that here, too, certain types of process have been neglected—the more intangible factors operating among the causes and instruments of conflict, the measures by which nonphysical force is applied and many of the results of its application, and the manifestations of nonphysical conflict. A great deal of unexplored geography underlies and helps to explain the political processes connected, for example, with political campaigns, with the conclusion of certain treaties, or the settlement of certain disputes in the United States Supreme Court, even where the immediate issues may not appear to possess any distinctively geographical characteristics.

For an understanding of political contacts and of the good or evil that they may cause, the elusive facts and concepts are as much needed as are the accessible ones and as closely connected with terrestrial circumstances. It is not because they are nongeographical but because they are hard to get at and to study in geographical terms that they constitute terrain still largely virgin. The cultivation of this terrain, because it presents difficulties, may be all the more attractive to those whose purposes in research are other than to follow lines of least resistance.

TRAINING FOR RESEARCH

Two qualities are requisite for successful research: enthusiasm and technical proficiency. Enthusiasm springs partly from confidence in one's ability to carry on research and partly from a vision of its pursuit as leading into fascinating domains of knowledge where challenging problems await solution. The ideal trainer for research is one who himself has such vision and the skill to project it in clear and colorful form before his students.

Research in political geography may be pursued with either one of two

main purposes in view: principally for what it may contribute to an understanding of the political behavior of mankind, or principally for what it may contribute to geography. In the first case, the end purpose is to explain from the geographical point of view the nature of political groups and of the processes that affect them. In the second, it is to explain how other things, such as the distribution of economic, social, or cultural conditions, or the general character of regions, are affected by the nature of political phenomena. Toward whichever of these goals research in political geography be directed, those techniques that seek to establish the patterns of the distribution of things and conditions on the earth's surface are indispensable tools, and all training programs should be designed to give proficiency in these fundamental techniques. They consist in the critical interpretation of existing maps, in the making of new maps, and in the ability to correlate given political data with given terrestrial data in terms of their areal relationships.

The larger problems of research, however, are connected with the explanation of the data so correlated—with the more hypothetical and controversial matters that involve not merely showing how things exist together in space but how they affect each other. Presumably, training programs in this respect should be so organized as to afford opportunities alike for those whose purpose it is to use political geography as an auxiliary to geography of other kinds, and for those who aim to apply geographical techniques toward a better understanding of political phenomena. These two goals are both worthy and meritorious. The geographical goal will be selected by students wishing to become well-rounded teachers of or scholars in geography. The political goal will allure many in the confusing post-war period, and the public demand for studies leading in its direction will doubtless be greater than it ever has been before. Man's political behavior has assumed such terrible forms of late that research in which it is made the center of analysis may well yield greater personal satisfaction to many students than studies that might appear to deal with problems of lesser human urgency.

As was pointed out at the beginning of this paper, the political geographer must know his way about in both the geographical and political zones of his subject. He must have a grounding in physical and economic geography such as that which our better university courses might be expected to give him. On the political side, he should doubtless be required to take courses and do some reading in political science. Geography and political science, however, are not the only essentials. History is also needed. The history presented incidentally in political science courses will not suffice and should be supplemented by broader historical study of a kind that I asume is required of advanced students in political science itself. Without the perspectives that historical study should give, research in political geography

can produce misleading results. If based too exclusively on consideration of contemporary facts, however skilful the use may be of maps and statistics, political geography is a thing of shallow geometrical designs. Maps and statistics, valuable tools though they are, disclose momentary and partial aspects only of the dynamic forces and processes that must be taken into account. Except possibly for historical geography itself, there is no other branch of geography in which historical-mindedness is more indispensable than in political geography.

Historical-mindedness should put the political geographer on his guard against oversimplification. The forces and processes with which he deals are of a very different and far more complex order than those with which the geomorphologist, for example, has to do. The geomorphologist studies forces over which he personally has little or no control and in which his interest is purely scientific. While he may harbor prejudices against certain theories regarding these forces, his judgment is not affected by personal loyalty to any particular geomorphic force or landform. He classifies delta building as constructive and glacial scouring as destructive, but he does not regard the one as thereby good and the other as evil. After having described, classified, and sought the explanation for peneplains, coral reefs, and the like, he does not feel impelled to advocate measures designed to alter them, because such alteration, except within very narrow limits, is beyond the power of man. The political geographer, on the other hand, cannot approach his subject in quite such an objective manner. Political processes and forces are definitely good or evil, though it is sometimes difficult to know which. The political geographer to some considerable degree has it in his power to alter or deflect them, both as a citizen and as a scholar. Through his vote and through his teachings and writings he can give support to forces that he regards as good. Furthermore, even if he thinks his studies are strictly impartial and coldly "scientific" and he refrains from the advocacy of specific measures of political action, his whole thought is affected by his political environment. He cannot avoid feeling partiality for or against different political groups and processes, and this inevitably colors and is reflected in his researches. Except on some of its purely descriptive levels, research in political geography is inextricably concerned with problems in political ethics—with good and evil—and any training for such research that failed to take this into account would be worth very little indeed.

The Training of Military Geographers

COLONEL SIDMAN P. POOLE*

Military geography may be defined as the application of geographic techniques and knowledge to the solution of problems in tactics, strategy and logistics. In all our history, until very recently at least, the only real military geographers have been those keen and, on the whole, successful soldiers who appreciated the relationship between terrain and operations and who more or less intuitively made the necessary correlations. Outstanding examples of such leaders were Jeb Stuart, Stonewall Jackson and Ulysses S. Grant.

Jeb Stuart, the great Confederate cavalry leader, was a master of tactics in their relation to terrain. He could judge almost instinctively the effect upon the speed of his cavalry of a soggy Virginia clay pasture. He had an uncanny eye for the cover a patch of woods afforded, the difficulties in terms of movement presented by the swamps of the Chickahominy, the passes of the Blue Ridge or the forests of Spotsylvania. And he could do the necessary thing: translate these into terms of fields of fire, defilade for his howitzers or approaches for a given number of his sabers. In choosing the right wind gap, the most feasible river crossing, the best cover and defilade, and in the quick appraisal of terrain as affecting the tactics and techniques of his army, he is perhaps unequalled in our history. Lee accorded him the accolade when he said after Stuart's death: "He never brought me a piece of false information."

In the appraisal of terrain for the strategic disposition and movement of troops, the master of them all was Jackson. The valley campaign of '62 in which he played hide-and-seek with the Federal armies of Banks and Fremont and McDowell is the classic example of applied military geography. Perhaps as never before or since in history were the movements of infantry divisions so perfectly synchronized with the wooded and rugged Shenandoah Valley on the one hand and the capabilities and weapons of his men on the other. All this to the end that mass and surprise and initiative were almost invariably favoring the grey clad "foot cavalry" wherever they clashed with the Federals. It is significant that at the very outset of this campaign Jackson trained himself, as Freeman records, and that "his initial lessons

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were in geography." He ordered his engineer officer, Major Jed Hotchkiss to make ". . . the maps which were to contribute to the sureness, and thereby to the speed and boldness of all (his) operations in the valley."

What the English critic, Col. J. F. C. Fuller, has called one of the finest operations of the Civil War was Grant's movement of the Army of the Potomac in June, 1864, from the lines of Cold Harbor to the trenches in front of Petersburg. This was not only a superb piece of strategy, splendidly executed, but it was a strategic operation the success of which depended essentially on the most accurate logistics, and these logistics were predicated on the most careful understanding of the terrain. It involved the movement of the entire Army of the Potomac along nearly 60 miles of narrow dirt roads, through a densely wooded and swampy region and over both the Chickahominy and tidal stretches of the James. All this maneuver was successfully concealed from the vigilant Lee until it was too late for him to strike at the 25-mile-long columns in blue. The detailed logistical studies necessary for this great march of a half dozen army corps speak eloquently for the skill of Grant's staff officers and especially of their careful evaluation of the topography of the region over which the operation was carried out.

THE REQUIREMENTS OF MILITARY GEOGRAPHY

The professional geographer fails as a military geographer because he usually is innocently ignorant of these basic principles of tactics, strategy or logistics. Some of the recent writings by otherwise able geographers who have brought out books and pamphlets under the headings of "Military Geography" have been ludicrous to military men. It is not alone sufficient that the geographer accurately describe a given beach, its gradient and exits, the material it is made of, the sea and swell, the offshore reefs, etc. He must know whether he can land a battalion or an army corps there, how long a time it takes to land them and what can be done with them after they have landed. If he does not have any idea of how many men there are in an army corps or in a battalion, his choice of beaches might result in tragedy. The good geographer may be able to read the position, size and outline of a patch of woods, provided the existing maps show these features. But if he has no idea whether those woods would offer cover for a company or a brigade or provide flash defilade from ground observation for "Long Toms," it is not military geography. Probably most geographers think they can point out on maps the major defensive phase lines offered by such ranges as the folded Allegheny Ridges. But can they point out *where* to place artillery? *When* to move division A from X to Y and *how long* before the rear elements of that division will clear the crossroads at Z? If they place their guns at M, can they lay down fire on the beach at N? All these,

and many similar questions, the answers to which require a sound knowledge of army organization, of modern ordnance and of the combined movements of the various arms, must be answered if one is to be considered a military geographer. The efforts of amateurs have usually been so academic as to be amusing and have tended to bring discredit upon the profession.

It is necessary to realize the unique demands of military geography and its exacting nature before one can lay down any program for the training of military geographers. The increasing complexity of modern weapons, vehicles and equipment intensifies the problem. Probably never again will war produce a Stuart or a Jackson who can, in the span of a few minutes, amidst flashing sabers or whining Minie balls, find solutions to problems as difficult as those involving terrain and battling human beings. Instead of this drama we must have staff officers trained in the art and science of war. And we must also have military planners who understand and appreciate the basic significance of all topographic features. This global war has produced this combination more completely than has ever before been done in the history of warfare.

A PRACTICAL PROGRAM FOR TRAINING

Let us consider a practical program for the training of military geographers for use in the next war. Let us assume that 200 such individuals will be needed by the armed services upon the outbreak of hostilities. And let us assume further that the War Department training program for the future contemplates an R.O.T.C. policy at our universities at least analogous to that developed under the Defense Act of 1921. With these as assumptions we can sketch the basic training for a competent body of military geographers. Just as the nation should not have to improvise physicians or ship architects or ballistic experts, so should it not have to improvise the men upon whose basic work depends so much the operational plans of army or navy.

Any program of training for the ends indicated and predicated on the assumptions given above, must depend for success upon the close cooperation of the War Department and the American universities that offer strong work in geography. The former, through the R.O.T.C. and Officers' Reserve Corps, must provide the basic military training. The universities must give the geographic foundation.

During his four years as an undergraduate member of the Cadet Corps the student will simultaneously be getting his degree with a major in geography. This is not the time or place to prescribe any regimented curricula to the geography staffs of American universities. There is no need for any radical changes whatsoever in this respect. The student of geography, who

desires to become later a military geographer and a reserve officer, will simply be given intelligent guidance towards those courses that will be of especial use to him.

Above all he should be well grounded in geomorphology and in land form interpretation. Basic courses in physical geology are highly desirable. He should have extensive and intensive work in map interpretation; geologic maps, relief maps, hydrographic charts and air charts. It is desirable that he get some acquaintance with the major map series of the world—their coverage, scales, projections, symbolization, etc. A sound understanding of meteorology and climatology together with an appreciation of soil science should be acquired. A warfare of planes and tanks necessitates that the geographer know the limiting effects of air conditions upon plane movements and of soils upon cross-country trafficability. And it would be well that the undergraduate take sufficient botany and ecology to have some appreciation of the extent and nature of the vegetative covering of this planet.

Several surprising weaknesses have shown themselves by the experiences of this war, even amongst men who have their doctor's degree in geography. Lack of cartographic understanding is one. Little or no field work is another. The world is the geographer's laboratory and the geographer must go out and "Dig and discover" for himself.

Upon receiving his baccalaureate and his commission as Second Lieutenant (F.A., Inf., C.E., S.C., etc.) it is then proposed that for the next two or three years the student, while getting needed experience as an officer, will be continuing his work towards his master's degree. The weak spots of his undergraduate career may here be strengthened. Wide regional courses, perhaps started in earlier years, should be here continued and more extensive field work undertaken. Probably during this period of his training is the most likely place to hope for foreign travel on the part of our average student. The lack of wide travel amongst American geographers is deplorable and every possible encouragement should be given it by both the universities and the government. Such travel is not only desirable for the military geographer; it is a must.

When a student begins work for his doctorate he has most likely chosen the area of his especial interest, and for the military geographer it is desirable that this should be outside of the United States, either in Europe or the Pacific or in Latin America. It would be presumptuous to tell our greater schools of geography what or how to develop a geographic understanding of any continent or of a portion thereof. And there is no desire nor need to recommend any narrowing of such a program by eliminating the economic or social facets of geography. We simply wish to emphasize that it is the

physical aspects that are usually of more direct value to the geographer when he wishes to present studies in military geography. And somewhere along this path to the doctorate more than a nodding acquaintance with French, Spanish, German—and Russian—will be found decidedly useful.

During the years he is working for his advanced degrees the student will also be attending camps in the summers and lectures during the winters. He will be there getting the basic military training he must acquire. In the years between the two World Wars the summer tours of duty were of two weeks' duration only. Extension courses and lecture classes varied greatly in number, content and value. It is to be hoped that this reserve training will be greatly extended and systematized and that a satisfactory method of picking specialists for special staff jobs will be found and adopted.

After some years—say six—with the arms the young reserve officer who wishes to be a specialist—a military geographer—will be transferred to some corps such as the Military Intelligence Corps which had a rather tentative beginning before World War II. As a member of this service the reserve officer—First Lieutenant or Captain—will be detailed for his summer training either to Washington—Military Intelligence Division—or to a Corps Intelligence Staff. Here he can get the picture of what is needed for overall planning and some understanding of the structure and channels set up to satisfy these needs. Finally as the crowning contribution of the War Department towards providing itself with specialists when it needs them is this proposal. Each year, some few of the officers whose training has been roughly as outlined, will be chosen for foreign service. Such a one chosen—perhaps a Major—will be accredited as an Assistant Military Attache for six months to some country in the area of his particular interest. Here, for this period, he will devote himself primarily to the acquisition of desired topographic intelligence. He should come back from such foreign service a better geographer, of more value to the country if called into the army and, we would hope, a wiser and more tolerant citizen through his broadening contacts with other peoples and places.

All of the program of training sketched above is admittedly only an ideal. Its success must depend upon the friendly understanding and close cooperation of the universities with the War Department. Both must be convinced of the value of geographic as well as of military training. It is impossible to assess the value to the nation of 200 such specialists in a time of great national emergency. May they never be needed, but if the call to the Colors comes again, let us be prepared. One possible way to preparedness has been outlined above.

Training for Research in Economic Geography

V. C. FINCH*

It is the purpose of this paper to consider some of the essential features of a program of training for students intending to conduct researches in the field of economic geography. This is relatively a new branch of learning. Only sixty-two years ago Götz published the first program for the organization of the field of economic geography and first employed the name.[1] In the infancy of the subject its students often have been equipped with only a general knowledge of their field and its border sciences, and their products have sometimes been elementary, uncritical and academic. The time has come when only the incautious would undertake research in economic geography without comprehensive discipline and a proper sense of his limitations. No one is so versatile that he may claim a complete mastery of this field. At its best economic geography approaches the quintessence of social understanding; at its worst it is shallow and dangerous pedantry. Generally, as it is practiced, it reaches neither of these extremes. It is comprised of descriptive accounts of economic phenomena interpreted in the light of their regional or environmental settings. Some writings on economic geography go farther and attempt the solution of problems in the proper distribution of industry and the establishment of principles capable of broad application in areal comparison. Too often the solutions are inadequate and the principles lack soundness. This is not surprising in view of the complexity of the subjects treated and the inability of the writers to recognize and evaluate the proper significance of all the many possible causative forces involved. This difficulty is not peculiar to writing on economic geography. It is encountered in all fields of learning, but it is particularly notable in the social studies and especially in economic geography.

THE NATURE OF ECONOMIC GEOGRAPHY

Geographers know well enough the general nature of the economic aspect of their field, but they are by no means in agreement on the details of its method or objectives. Perhaps this is in part owing to its newness. Certainly, however, the student who looks in the writings of modern geog-

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[1] Karl Sapper: Economic Geography. *Encycl. Soc. Sci.*, Vol. VI, pp. 626–628.

raphers for opinion will not be encouraged by its unanimity. By some writers the nature of the field is assumed without definition, and they proceed to its cultivation by various means and without apology or explanation. To Carter and Dodge[2] the subject matter of economic geography is the solution of a dual problem, "the localization of production and the specialization of regions." In the solution of these problems they call into account two sets of factors, viz., physical factors and those of an economic or institutional character. With this approach Jones and Darkenwald[3] seem generally to agree, although their method of treatment and emphasis differs considerably from that of the authors mentioned above. Jones and Whittlesey[4] add a further objective that "the peculiar contribution of economic geography is an understanding of the relation between natural environment and economic life in the various regions of the earth." This viewpoint seems to require a regional approach to geographical understanding as opposed to the topical or industrial approach employed more or less consistently by some. It is a viewpoint in general agreement with that of Hettner, to whom "economic geography is concerned with the economic potentialities and relationships of the various countries and localities."[5] Others who have ventured opinion lay particular emphasis on the dynamics of human economy and the positive adaptation of economic activities to the physical environment.

Thus the field of economic geography is seen from various points of view, and we are forced to conclude, as was stated above, that it is comprehensive even under the most restricted interpretation. Indeed, as Hartshorne[6] has stated "geographers are justified in regarding human or cultural geography very largely in terms of economic geography" and, "since economic geography requires detailed consideration of the natural features to which economic phenomena are related, a regional study in economic geography constitutes the greater part of a full study in geography. Sauer[7] appears to agree with this viewpoint and to go farther to include the dynamics of history, for he says "The economic geography that is in the making is nothing else than culture geography carried down to date, for the culture area is essentially economic, and its structure is determined by historic growth as well as by the resources of the physical area."

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[2] W. H. Carter and R. E. Dodge: *Economic Geography,* New York, 1939, p. 4.

[3] C. E. Jones and G. G. Darkenwald: *Economic Geography,* New York, 1941, pp. 7–8.

[4] W. D. Jones and D. S. Whittlesey: *An Introduction to Economic Geography,* Chicago, 1925, p. 3.

[5] Karl Sapper: *op. cit.,* p. 627.

[6] Richard Hartshorne: The Nature of Geography, these *Annals,* Vol. 29, 1939, p. 576.

[7] Carl Sauer: Culture Geography, *Encycl. Soc. Sci.,* Vol. VI, p. 623.

THE NEED OF A BROAD FOUNDATION

It is the common experience of those who undertake research problems in economic geography to find that they need greater familiarity than they possess with the facts and methods of border fields of learning and also an awareness of the real differences between such correlative facts and methods and those that are distinctly geographical. Doubtless that will continue to be true. However, the generation of geographers now in training has a better opportunity to get adequate grounding in the collateral disciplines than their predecessors had, provided they are broadly and soundly advised. This is not merely because there is greater recognition of the need on the part of both the student and his adviser. In recent years there has been in various of the border fields a development of types and methods of instruction more specific for the geographer's needs. Moreover, these aspects of training are now so widely cultivated that, in most of the institutions where geographers are being educated, there is a comprehensive selection of them available.

Not only is this crossing of academic boundaries desirable, but inquiry seems to show that in many American universities greater legislative provision has been made for its encouragement. The setting up of divisional organizations among the departments of instruction tends in that direction. If the modern student is actually deterred from a proper broadening of his training it apparently results mainly from his own desire for early specialization or from the attitude of his major department or professor, holding to a doctrinal groove to the suppression of curiosity on the part of the student. In general, the machinery for a broad training exists, and it is the curious student who is on the trail of evidence or in search of new methods who crosses the boundary lines most frequently.

KINDS OF TRAINING REQUIRED

At the core of economic geography lies a body of material in which all would agree that the student should be proficient. It is factual and descriptive and concerns the patterns of occurrence, production and movement of a multitude of things; products of soil and forest, resources of the earth and the evidences of human labor. This knowledge is assumed to be the common possession of all who have passed the elementary phases of their training. It is the interpretation of the significance of these things and their associations that calls for a broader understanding and requires the adaptation to geographical objectives of the thought and principles of border fields of learning.

The economic geographer deals with a complicated mechanism. The study and practice of it should be undertaken by people of considerable

maturity and, better still, by those who have, in addition to their academic training, some experience in the world of practical economic affairs. However, since one can hardly be expected to know the precise significance of all the component elements of the subject, different degrees of competence in them must be admitted. With some of them he must have a thorough acquaintance, with others his acquaintance may be limited to a working knowledge. Almost inevitably there will be some of which he has inadequate understanding, since the elements are so many, and time and human capacity are limited. The problem of training therefore resolves itself into a question of choice. Which of the elements or fields of learning are most nearly indispensable for general use? Which may be passed over lightly until a particular research problem requires their employment? In this direction lies the greatest divergence of opinion.

In the United States and in Germany, where geography has been closely allied with geology there has been general insistence upon thorough training in the physical fundamentals. Not so generally has this been true in France where a closer alliance between geography and history has prevailed. Even among American centers of geographical training there has been some divergence of practice in this respect. However, it is commonly held that the required areas of special knowledge may be included in three major groups which are (1) the earth sciences, (2) the social sciences and (3) the geographical techniques.

TRAINING IN THE EARTH SCIENCES

Whatever the divergence of opinion with regard to the degree of training required in the earth sciences, there is little argument about the types or areas of required understanding within the earth-science field. Obvious, but too often permitted to pass without emphasis, is the element of location, actual and relative. Geographers speak often of pattern, but pattern is relative location, and relative location is without meaning unless it rests upon a positive frame of reference. This, in turn, can be nothing other than knowledge of the situation of places on the earth, a knowledge too much neglected at the elementary level where its foundation should be laid.

By almost unanimous consent it is held among geographers that climatic phenomena touch upon the economic activities of man in more ways and at more points than does any other of the elements of physical environment. The student of economic geography must, therefore, know physical climatology and regional climates or climatography well. These are fundamental to the process of regional analysis and to an understanding of areal economy.

Of almost equal, and locally of greater, importance is a knowledge of the other physical elements of geography; slope, soil character, native vegeta-

tional resources, and the economic minerals. True it is, as some maintain, that economic geographers are concerned primarily with the slope patterns and characteristics of areas and not with the genesis of these features. And yet, by what system of shorthand can the significant features of these elements of the economic complex be more conveniently developed than by the systematic approach of geomorphology? The same reasoning may be used to support the need for training in the fundamentals of soil science, ecology and economic geology. The serious student of economic geography has need of them all. He can not, of course, become an expert in each of these fields of knowledge with reference to the entire earth, but he should command sufficient of their terminologies and techniques so that he may employ them intelligently in the solution of the geographical problems of particular areas and industries.

TRAINING IN THE SOCIAL SCIENCES

In America there has been a later recognition of the need for, and a much less uniform practice with respect to, insistence upon training in the social science fields basic to the profession of economic geography. True, the need has been recognized, and there has been commonly a gesture toward its fulfillment. In general, however, there has been no agreement on a plan or sequencies of studies, and the selection has been more or less fortuitous.

Economics. The close relationship between economics and geography has long been evident, and research workers in both have been cultivating the border field. Most of the economists have felt their inadequacy in the details of physical science as keenly as the geographers have felt their inability to cope adequately with the intangibles of economic theory. Although for the purposes of economic geography both groups of workers may use the same source materials, their relative emphasis and their ways of exploiting are, as Sapper[8] has noted, essentially different. While this difference is pronounced in theory, it is not always so in practice. The recency of the evolution of thought in human geography has not permitted the development of standard methods for adapting the materials of economics, history and sociology to the purposes of geography, and too often they are presented without proper digestion.[9] In some instances economists and geographers have collaborated on problems and pooled their methods and resources with good effect. However, this does not relieve the geographer of the need of training in economic theory and in certain areas of economic specialization, particularly land economics, industrial

[8] Karl Sapper: *op. cit.*

[9] Richard Hartshorne: *op. cit.*, p. 590.

economics, the economics of transportation and economic history. Fortunately, so many universities are now equipped to train students in some or all of these branches of economics that the student of geography may supplement his major studies with a planned selection from these areas as best suits his purpose.

Just what is it the geographer may hope to gain by special studies in economics? The body of principle or theory peculiar to economic geography is not well developed, and although some such principles have been stated, they mainly lack anything like universal demonstration or applicability. Those that are most employed in geographical reasoning are but special cases of accepted economic principles. Sir Josiah Stamp has stated the case for the relationship between geography and economics, and the student will do well to note his opinions and his attempt to classify geographical explanations of economic facts.[10]

History, Sociology and Anthropology. The trend of modern economic geography toward the interpretation of areal economy requires that causal relationships be sought in whatever direction they may be found. Consequently geographers make use, not only of economic data, but also that of history, sociology and anthropology. This is inevitable if one accepts the opinion of Sauer that "economic geography is nothing else than culture geography brought down to date." Culture forms derive in part from culture history, and a knowledge of culture origins is obviously a necessary part of the background of the economic geographer.

To what extent the geographer should command the limitless details of factual material embodied in these fields is a matter to be governed by circumstances. Certainly he can not be expected to have expert knowledge of them all. He should, however, know their distinctive methods and techniques to the extent that he may be aware of their relative soundness and their degrees of application to his problems in the origin and distribution of the culture features and traits in an areal complex. Among the methods of the other social sciences are some that have direct application to geographical research. One of these is bibliography. The literature of economic geography itself is voluminous and that of contributory fields enormous. Library research therefore requires a command of sound bibliographical method, and in this the historians excel. Although the student of economic geography must acquaint himself with a wider array of source materials, the general feaures of bibliographical methods employed by history and the other social sciences may be applied to his problems with little modification.

[10] Sir Josiah Stamp: Geography and Economic Theory, *Geography*, Vol. XXII, 1937, pp. 1–14.

OTHER PERTINENT TECHNIQUES

The method of economic geography, as of all phases of cultural geography, requires that its facts be subjected to certain procedures. These are *observation, analysis, description, symbolization* and *classification.* Of these, description requires only an application to special cases of the technique of clear statement which supposedly is one of the accomplishments of every educated person. The method of classification should have been acquired through studies in the basic sciences. The techniques of geographical observation, analysis and symbolization may not, however, be so generally taken for granted and should be improved by special training.

Field Method. The purpose of field training in cultural geography is to give the student experience in the distinctively geographical techniques of observation. It raises questions of what to observe and how to record these observations for geographical purposes. Familiarity with these ways of doing is as necessary to the economic geographer as field practice is to the geologist, but the method is entirely different, since it involves not only visual observation but the techniques of interview or questioning and other devices for uncovering facts hidden from the eye. In this respect the field methods of the anthropologist and sociologist may be helpful and suggestive, but they require modification and adaptation to peculiarly geographical ends.

Statistics. The source material for the development of ideas and the solution of certain types of problems in economic geography lies to a remarkable degree in official statistics. This is well known to all geographers, but too few who work in this field are masters of statistical method. For the coming generation of students this type of training is indispensable. This is a field in which interdepartmental cooperation is desirable. Unfortunately, in some institutions where geographers are trained this tool subject is developed incompletely while in others it supplied in duplicate without particular application to the needs of geographers. There are courses in statistics and statistical method in the theoretical form required by mathematicians, statistics for the economist and for the sociologist. Of these, the last named is perhaps most satisfactory for the student of geography, but we are generally lacking in a type of general statistical method suitable for students in all the groups of the social studies field. This might, more than any of the special courses, be suited to the geographer's need. Not only is there failure among geographers to recognize the need for this essential tool, but among students in geography there is little attention even to the mathematical prerequisites that make such training profitable or possible.

Cartography. No other of the social studies than economic geography insists upon so rich a symbolization of its facts and concepts in cartographic form. This is, indeed, one of the distinctive contributions of our science.

It follows that all students in this field of learning should be well versed in the problems of cartographic representation and reproduction. A survey of geographic publications shows all too clearly how ill-adapted many of the map and diagrammatical devices employed are to the purposes for which they were intended, and how often only a few minor changes would have improved their effectiveness had the author been more familiar with the range of devices and techniques at his disposal. Moreover, the editorial staffs of the geographical periodicals know to their sorrow how many good-looking manuscript maps and diagrams present almost insoluble problems in printing owing to failure of the authors to grasp the elements of scale and proportion in drawing for reproduction. Some editors, as is well known, insist upon redrawing practically every map submitted. This condition requires correction.

OBJECTIVES INFLUENCE TRAINING

The profession of economic geography has two possible objectives, the academic and the practical, which are likely to have some influence on the nature of the training of those who undertake it. Götz pointed this out, distinguishing between economic and commercial geography on this basis.[11] Since modern economic geography has practically taken over the body of material of the older commercial geography, it may be held that the two objectives are now co-existent within the one branch of the field. In western Europe and in America it is the academic objective that has generally prevailed. However, Sapper[12] has noted that "in the Union of Soviet Socialist Republics economic geographers are no longer interested in the bare descriptive, statistical inquiries of prerevolutionary economic geography, but are specializing in intensive studies of the present regional distribution of types of economic activity and in devising principles and practical programs for a coordinated development of these resources in terms of regional integration." Vasutin[13] also has described this trend, and places great emphasis upon the part to be played by the geographer in the regional planning necessary for the socialist construction in the Soviet Union.

Although the situation in America is different in many ways, it may be well for geographers to consider more carefully their relationship to planning enterprises and their immediate responsibility to public service. Such an orientation will not alter the need for the core material that has long been

[11] Karl Sapper: *op. cit.*, p. 627.

[12] *Op. cit.*, p. 627.

[13] V. F. Vasutin: The Status and Immediate Problems of Economic Geography, *Problems in Economic Geography*, A collection of papers edited by V. F. Vasutin and N. A. Kovalevski, Communist Academy, Moscow, 1934. Translated in digest form by William Applebaum. (Manuscript.)

held to be inherent in economic geography. It may, however, occasion a shift in emphasis from an attempt to interpret the present in the light of the past to an attempt to plan for the future in the light of principles which are as yet but imperfectly organized. Whatever the trend of future practice in economic geography it is certain that training for research in that field means training in the recognition of problems and in the means of their solution by critical measures and with logical and intelligent conclusions.

Douglas Johnson

ARMIN K. LOBECK

A full account of Professor Douglas Johnson's unusual career and a fine tribute to him as a man and as a research scholar, prepared by Dr. Frank J. Wright, of Denison University, will be published early in 1945 in the *Bulletin of the Geological Society of America.* Dr. Wright has already done me the courtesy of allowing me to read the first draft of his memorial, and I shall therefore avoid reference to those things which he has been able to say far better than I. Your editor has, however, asked me to prepare for the ANNALS a statement of more restricted scope which might beguile the younger geographers of today into a systematic reading of Professor Johnson's many papers, not alone for their scientific content, but as commanding examples of logical reasoning and lucid presentation of ideas. There are certain traits in a man's character which express themselves equally in his everyday acts and in his writings. I am sure it will be helpful, therefore, to the future students of Professor Johnson's writings, to know something about the personal character of the man who produced these works. Having been intimately associated with Professor Johnson during the past 30-odd years, I had on many occasions opportunity to observe and ultimately to be much impressed with the methods which he evolved and employed in so masterful a manner, both in developing his subject and in laying it before his readers.

I suppose the characteristic of Professor Johnson's mind which I noticed most frequently and consistently was his love of order. He loved order in all of its manifestations. In a broad way he loved the orderly processes of nature. To him, there was a reason, an explanation, for everything, if it could only be found. He liked system, arrangement, and a plan in his personal affairs, as well as in his dealings with others. He regimented his own life, and in some ways he regimented also the activities of the students under him.

Early in life Professor Johnson became a lover of France, of her traditions and her language. The lucid expositions so characteristic of French scientific writing, the ever apparent logic which allowed of no hidden meaning or obscure conclusion, all these endeared themselves to him. He emulated the style of French writers, and in his lectures there were mannerisms of speech and even of expression and gesture that reflected the influence which France and her language had upon him. For years he kept a book of French literature at his breakfast table and from it read a few pages every morning aloud to Mrs. Johnson.

DOUGLAS WILSON JOHNSON, 1878–1944

The blindness of Alice Johnson was, I think, a big factor in requiring of Professor Johnson a regimentation of his personal affairs more rigid than that imposed by most men upon themselves. Many of the problems of daily life that the average man delegates to his wife, or which she assumes, were in Professor Johnson's case handled by himself. To have any time left at all meant that he had to have his affairs well in hand and that small decisions had to be made promptly. If such decisions proved wrong he justified them on the ground that time had been saved which otherwise would have been spent in needless discussion. These expedients were accepted in a spirit of merriment by Mrs. Johnson who recognized the necessity for them.

So it was by numerous devices that Professor Johnson learned how to regulate his affairs and to evolve a system of living which was truly remarkable. Self-discipline was one of the reasons for his success. Even his hours of relaxation were ordered and planned. When I was still one of his students he had me set aside certain hours each week for a game of tennis with him because his physician recommended some physical diversion. I cannot recall many instances when Professor Johnson fully relaxed and let precious moments of life slip by with no accounting for them in some purposeful way.

This love of order, this devotion to system guided also his esthetic outlook upon things of nature. Not only did he, as a student, seek to explain the forms of landscapes and to find in them an expression of rule and order, but he also looked upon these products of the physical world as things not to be violated by the ugly works of man. He had a sensitive feeling for what was appropriate in the midst of noble scenery and was keenly hurt when students on his field trips failed, through lack of punctilious behavior, to reflect the mood of respect which he had hoped that these surroundings would inspire.

I always gained the impression that Professor Johnson was very conservative. This attitude of conservatism came from his dislike to see the established rule of things disturbed. He was much more likely in his teaching and his scientific thinking to use the methods of reasoning whose worth had been demonstrated, than to plunge into the attack with new weapons. He rarely did the unexpected, nor was it his custom in class to depart from propriety in any way. Occasionally I have noticed that situations which I thought quite funny did not meet with his approval, I presume because they did not conform with established procedure and custom.

Professor Johnson had few idiosyncrasies or mannerisms. He did not exhibit the personality of expression which belongs to those with artistic temperaments. He was guided by reason rather than by intuition and was prone to rationalize his actions. He conformed to the rule. This was especially true in his attitude toward those in positions of authority. He liked

to be well thought of and cherished the many honors which had been conferred upon him. Even more, I believe, he prized the personal recognition of the many men of distinction whose signed photographs adorned his office walls. There were such men as President Wilson, Marshal Foch, General Bliss, Mr. Lansing, and other notables of the First World War.

Professor Johnson walked and talked on equal terms with men of quality, and in the course of his life he met many of them. They accepted him also as one of themselves. It was part of his scheme of life to cultivate such friendships and I think I know how it began. Professor Johnson from his days at Cambridge was a great admirer of N. S. Shaler. He was entranced by the stories of Shaler which still were fresh on the Harvard campus and especially by the life story in Shaler's Autobiography. No young geologist can read that absorbing book without wanting to follow a similar path. Often, in later years, Professor Johnson cited this book to me and talked about Shaler's road to fame. He himself must have emulated Shaler for he was always impressed with the way Shaler came to know all the great men of his day in both the United States and Europe.

To put all this in another way, Professor Johnson's path was a studied one. He did not leave things to fate. There was in him little of repose and laissez faire. To him life was made up of valuable minutes from which their full worth must be wrung. To some extent he must have felt this turmoil within him for over his desk in recent years he had a card which reminded him to "Live Serenely." Perhaps a cigar or a pipe might have diverted him, but one cannot imagine him relaxing in that way. He never played cards, I believe, at least to any extent, and yet it would seem that a game like contract bridge would have appealed to him. Of course, the blindness of Mrs. Johnson cut him off from many forms of amusement and diversion. They both were lovers of music and poetry. Some of Alice Johnson's short verses are lovely. Moving pictures, until they became talkies, were out of their realm, but I know that they both enjoyed good plays. At the theatre Professor Johnson, with great tact and at exactly the opportune moment, by a word or two, apprised Mrs. Johnson of a situation, a movement, a costume, which she could not see, but a knowledge of which would help her appreciate the dialogue.

I have perhaps digressed a little from the theme of this paper, and will now return to an illustration of Professor Johnson's love of orderliness and regimentation. For several years he conducted a three-day field excursion by bus from New York to Gettysburg for students in elementary geology. He prepared and had published a guide book for this excursion with the paragraphs numbered to correspond with the sequence of features to be observed en route. There were no parts of the journey left unde-

scribed, and therefore at any given moment a certain paragraph in the book would be in force. The number of the paragraph *en courant* would be hung up at the front end of the bus by the assistant who occupied the front seat. A second assistant occupying the back seat would hang up a similar large printed number visible to the following bus, and in this bus a corresponding number was also displayed so that at all times all students would simultaneously be reading the right paragraphs and presumably be looking at the right scenery. It is true that frequent stops were made, but it was expected also that members of the class would not relax too completely between the stops. Professor Johnson kept the class alert by suddenly asking a student what certain features in the landscape were, or perhaps by simply asking him where the party was at that moment. He was a great believer in sticking constantly to the job. If there was nothing else to do, then follow the route on the topographic map and note every turn, cross-road, and house, so that one's whereabouts were always precisely known. Likewise, in the administration of his university department, almost nothing was too small or too insignificant to deserve attention in his desire to organize departmental affairs systematically.

Professor Johnson's attitude toward graduate students was far more kindly and considerate than would be suggested by some of the dictatorial methods in which he professed to believe. He used to talk to me, during my early years of teaching, about his conversations with Dean Woodbridge of the Graduate School. It seems that the dean was an exponent of the European attitude toward graduate students, namely that the student exists for the benefit of the professor; that a student who wished to work under a certain professor should be willing to work on parts of the problem upon which the professor himself was working and thus contribute to its solution. It is easy to see that in lieu of paid research assistants, this system would be a great boon to any man devoting himself to research. Professor Johnson expressed himself to be a believer in this method and told me that his students would henceforth have to interest themselves in the problems upon which he was himself engaged, and that he did not intend to give his time and energy to supervising problems of remote interest to him. The idea that the student existed to help the professor appealed to him, and for several years he tried to put this into practice. It must of course be understood that many students were only too keen to become apprentices under such a master as Professor Johnson. Many of them had no preference of their own anyway, and in most cases it was a happy procedure for all concerned. Professor Johnson's research problems became the research problems of his graduate students. Nevertheless, this was no complete solution to the difficulties of prosecuting the kind of research in which Professor Johnson

was engaged. So gradually he began to assemble about him a staff of paid research assistants. He had at one time as many as three trained people working full time on his problems, as well as a full-time personal secretary. This proved to be an admirable research organization. It was during those days that, because of Mrs. Johnson's health, Professor Johnson had to be absent many months each year from the university. But his research went on even better during these periods. From his quiet retreat in Florida he directed his investigations into the literature of his problems. There was a daily interchange of mail or telephone conversations with his office. His manuscripts were evolved with the closest checking of every possible detail. And, when printer's proof began to arrive his competent office staff took the full responsibility of reading it. This method of remote control meant that he rarely if ever dictated any part of a technical paper. He used sufficient care in his penmanship so that the typing of his notes was readily accomplished. There were always half a dozen or more copies made of the final draft and these were mailed out to various individuals who might be qualified to criticize his results. The organization and planning of this routine work was like a well oiled machine, and when one understands the procedure by which these things were managed he can begin to understand how it was that Professor Johnson was able to accomplish so much, in spite of certain very serious handicaps. One is tempted to suggest that his misfortunes were the secret to his success, for they forced him to conserve his time and his own limited energy and thus led to these very methodical ways of getting things done.

There remains now something to be said about Professor Johnson's scientific thinking. A perusal of his many writings from the earliest ones to the present reveals a definite striving to evolve ideas by systematic processes of thought. Professor Johnson did "make thoughts his aim." In one of his earliest lectures, which I heard about the year 1914, he set down the four steps of scientific thought. These were, first: observation or assembling of facts; second: the development of hypotheses to explain them, an inductive process of logic; third: deduction of additional expectable facts for each hypothesis; and fourth: the testing of each hypothesis by confronting the deductions with field observations. The evolution of thought processes with Professor Johnson was closely related to the methods of presenting the results of his thinking to his readers. He studied closely the various ways that W. M. Davis and other writers use to lay their material before the public. Davis' Essays, which he edited in his formative years, and especially the essay on River Terraces of New England, were eloquent guides which gave him the cue for his own later efforts. From these studies came his series of articles in the *Journal of Geomorphology* on methods of

scientific presentation. These I commend as required reading to all young writers. To study in chronological order the various essays of Professor Johnson, with the purpose of noting in each case the method of reasoning adopted, together with the method of presentation, would be a wholly fruitful occupation for any graduate student in geography or geology, regardless of his more restricted field of particular interest. He would detect a constant striving to find the most appropriate form in which to array his final results and the steps which led up to them. In many cases it is true the author gives no hint that he is working according to any plan. In other instances, however, he takes the reader into his confidence and lays before him the tricks of the trade.

The culmination of Professor Johnson's efforts in the matter of presentation and in an analysis of scientific thinking was his Sigma Xi National Lecture, entitled Mysterious Craters of the Carolina Coast, A Study in Methods of Research. This was published in the *American Scientist* for January, 1944, Vol. 32, No. 1. In this paper he elaborates considerably upon the four steps which, earlier in his career, he listed as the appropriate ones to use in the search for a true explanation of natural phenomena. But there was no fundamental change in his scientific approach during the preceding thirty years, nor could there well be, for at the outset he adopted the one and only method which, with modifications, could be applied by scientists to all fields of investigation. It seems hardly necessary in this connection to summarize Professor Johnson's technique. A complete reading and careful study of the paper just referred to is desirable. The gist of the whole matter is simply this: a man's thinking may, on the one hand, be haphazard, intuitive, unregulated, and left to chance; or, on the other hand, it may be orderly, methodical, and controlled by a definite and logical procedure. Whether one agrees with Professor Johnson's conclusions or not, the fact remains that it is very difficult to refute what he says because his statements are all backed by an impressive array of reasons which can not easily be disputed.

Professor Johnson, like the poet of old, saw the world "harmoniously confused, not chaos-like together crushed and bruised, but a place where order in variety we see, and where though all things differ, all agree."

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